MEDICAL PROCEEDINGS

MEDIESE BYDRAES

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REDAKSIONEEL · EDITORIAL

MERKWAARDIGE VORDERING IN DIE BEHANDELING VAN BEENBREUKE?

In hierdie uitgawe publiseer ons die eerste omvattende verslag oor 'n nuwe tegniek vir die behandeling van beenbreuke met behulp van 'n sintetiese materiaal, nl. poli-uretaanskuim.*

Poli-uretaanskuim is nie 'n gom nie, maar 'n metode vir binne-murg-fiksering, met die opvallende gevolg dat die pasiënt binne enkele dae nadat hy die beenbreuk opgedoen het, weer ambulant is en gewig op die been kan laat rus. Die prognose is natuurlik selfs beter in die geval van breuke van die boonste ledemaat, want hier is daar 'n bykomstige voordeel. Geen metaalversterking is naamlik nodig as poli-urestaanskuim gebruik word om die gebreekte bene saam te hou nie.

Dit is pionierswerk in Suid-Afrika waaroor daar nou vir die eerste keer verslag gedoen word deur dr. E. M. McLean, wat aan die Ernest Oppenheimer-hospitaal op Welkom in die Vrystaat verbonde is.

Die opvallende nuwe tegniek wat deur dr. McLean beskryf word, kan bes moontlik 'n heeltemal nuwe sfeer oopstel vir sover dit die behandeling van beenbreuke betref. In die Verenigde State (waar hierdie tegniek vir die eerste keer ontwikkel is) het die indikasies tot dusver beperk gebly tot gevalle van nie-aan-

*Bemark deur die Wm. S. Merrell Company as *Ostamer*.

A NOTABLE ADVANCE IN THE TREATMENT OF FRACTURES?

In this issue we publish the first comprehensive account of a new technique for treating fractures with a synthetic material, viz. polyurethane foam.*

Polyurethane foam is not a glue, but a method of intramedullary fixation, with the striking result that the patient may be ambulant and weight-bearing within a matter of days after sustaining his fracture. The prognosis is, of course, even better with fractures of the upper limb, where there is the added advantage that no metal reinforcement is necessary when using polyurethane foam to hold the fractured bones together.

This is pioneering work in South Africa, reported on here for the first time by Dr. E. M. McLean, working at the Ernest Oppenheimer Hospital, Welkom, O.F.S.

The extremely novel technique described by Dr. McLean may well open up a new field in the treatment of fractures. In the U.S.A. (the field where this technique was first developed) the indications so far have been cases of non-union, pathological fractures and chronic infections of bone.

The South African experience at Welkom (limited though it is) has been somewhat different in that up to the present encouraging

* Marketed by the Wm. S. Merrell Company as *Ostamer*.

sluitende, patologiese beenbreuke en chroniese infeksies van die been.

Die Suid-Afrikaanse ondervinding op Welkom (wat weliswaar beperk was) het egter ietwat hiervan verskil, want tot op hede is bemoedigende resultate met onlangse beenbreuke —geslote of oop—behaal.

'n Bestudering van dr. McLean se referaat toon duidelik aan watter strenge eise daar aan die chirurg se vernuf gestel word, veral by die voorbereiding van die fraktuurbed en die aanwending van die poli-uretaanskuim.

Dit skyn asof dit hoogs wenslik is dat diegene wat hierdie behandelingmetode wil gebruik, eers as vakleerlinge moet dien onder praktisyns wat ervare en bedrewe in die toepassing van hierdie besondere tegniek is. Hier het ons inderdaad 'n geval waar 'n mislukking gewaarborg kan word tensy die allergrootste sorg aan iedere besonderheidjie bestee word.

Dit is derhalwe met groot genoeë dat ons kan aankondig dat sodanige fasiliteite wel op Welkom by die Ernest Oppenheimer-hospitaal bestaan. Hierdie hospitaal sal dan ook alles in sy vermoë doen om hulp te verleen aan diegene wat aktuele belang in die bemeestering van hierdie tegniek stel.

Al die implikasies van hierdie buitengewone herseltegniek is nog nie duidelik nie. Die indikasies en kontra-indikasies sal bes moontlik opnuut geëvalueer moet word in die lig van toenemende ondervinding, maar dit lyk asof die metode groot verligting aan die slagoffers van ongelukke sal besorg, veral deur dit moontlik vir hulle te maak om gougou na hul normale bedrywighede terug te keer met min of glad geen pyn nie.

In die geval van patologiese beenbreuke wat van ernstige pyn vergesel gaan, is daar in die Verenigde State bevind dat die kliniese verligting vinnig en merkwaardig was.

Poli-uretaanskuim skyn leweloos te wees, maar ons weet dat dit uiteindelik deur nuwe beenvorming vervang word. Gevolglik moet dit stadig gemetaboliseer word. Geen inligting oor die metaboliese pad waarlangs hierdie materiaal die liggaam verlaat, is op die oomblik beskikbaar nie, en dit alleen behoort voldoende rede vir versigtigheid en waaksaamheid te wees. Maar aan die hand van die bewyse opgelewer deur proefondervindelike toksisiteitstudies met diere, is daar tot dusver niks wat aandui dat nadelige gevolge verwag hoef te word nie.

Ons onkunde oor die metabolisme behoort ons egter tot versigtigheid te maan by die keuse van gevalle, maar met die oog op die kennis wat reeds opgedoen is, sou dit onredelik wees om nie gebruik van hierdie merkwaardige terapeutiese ontwikkeling te maak nie as daar goeie redes is om dit te doen, veral as daar in gedagte gehou word dat die finale indikasies vir gebruik alleen deur ondervinding aangedui kan word.

Hoewel die Suid-Afrikaanse navolging van die behandelde gevalle baie kort was, kan die resultate wat tot dusver behaal is as bemoedigend beskryf word. Oor die algemeen stem hulle ooreen met bevindings in die Verenigde State in gevalle waar poli-uretaanskuim op die korrekte manier gebruik is.

results have also been obtained with recent fractures, simple or compound.

Perusal of Dr. McLean's paper makes clear what exacting demands are made on the surgeon's technical skill, especially in the preparation of the fracture bed and the application of the polyurethane foam.

It seems in the highest degree advisable that those seeking to apply this method of treatment should serve an apprenticeship under practitioners experienced and skilled in the use of this technique. This, indeed, is an instance where, unless every detail is attended to very meticulously, the results can be guaranteed to go wrong.

It is therefore gratifying to be able to report that such facilities exist at Welkom at the Ernest Oppenheimer Hospital, which will do everything possible to assist those seriously interested in mastering this form of treatment.

All the implications of this unusual technique of repair are not yet clear. The indications and contra-indications may yet need re-assessment in the light of a growing experience, but it does seem that the method offers great relief to the victims of accidents, especially in respect of making possible their early return to normal activities with little or no pain.

In pathological fractures associated with severe pain, the U.S.A. experience has been that relief clinically was rapid and remarkable.

Polyurethane foam appears to be inert, but we know that it is eventually replaced by a new formation of bone, so that it must be metabolized, however slowly. No information is yet available about the metabolic pathway concerned in the elimination of this material from the body. This alone is a cause for care and alertness, but on the evidence of experimental toxicity studies on animals, there is nothing so far to suggest that any deleterious effects may be expected.

Our metabolic ignorance should, however, make for caution in the selection of cases, but the knowledge already gained makes it unreasonable not to employ this remarkable therapeutic development when there is good reason for doing so, especially when it is appreciated that only experience can provide the final indications for use.

Although the South African follow-up of the cases is very short, the results so far must be described as encouraging, and they conform in general to the findings in the U.S.A. in cases where the polyurethane foam has been mixed correctly.

INTERNAL FIXATION OF FRACTURES

BY MEANS OF POLYURETHANE FOAM

A PRELIMINARY REPORT

ELDRED M. MCLEAN

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Attention has been focused recently on a polyurethane ('Ostamer') for the stabilization of fractures; this substance has been incorrectly termed a 'bone glue'. It has very recently been released by the United States Food and Drugs Administration for general use.

The object of this publication is to clarify the operative procedure involved in its use and to emphasize some of the practical points which can, and do, make the difference between initial success and failure.

Weight-bearing is allowed very soon, and the fact that its correct use enables the patient to return to a normal life at an early stage is one of the great advantages of polyurethane. Such return is a factor of great economic importance in injuries sustained in road and industrial accidents; less so, perhaps, in Mine Natives (who receive free treatment, unlimited in duration) than in European wage earners.

Apart from weight-bearing, however, early active movement, pain-free, is a most important factor in restoration of function, while residual permanent disability from limitation of movement of joints is one of the penalties of prolonged immobilization.

In the field of traumatic surgery and orthopaedics, any means which holds out (without undue risk to the patient) the promise of avoidance of permanent disability must be investigated, and the approach should be a positive rather than a negative one. The inadvisability of 'converting a closed into an open fracture' is readily conceded, but on the score of risk of infection the advent of antibiotics has rendered it something of a surgical *cliché,* and those who quote it freely might well ponder its meaning. In fact, modern orthopaedics and surgery have long ago discarded many surgical aphorisms once accepted as professional gospel, but it is still a truism that success or failure depends to a large extent on the skill, judgment and flair of the individual surgeon in any specialized procedure.

Dr. Michael P. Mandarino, of Hahnemann Medical College in Philadelphia, initiated the present work in the U.S.A. After experimenting with numerous substances and in the light of favourable animal experiments over the past 10 years, he eventually settled, about 5 years ago, on the use of a polyurethane foam. He was assisted in his experimental work by Dr. J. E. Salvatore. The Du Pont Company refined and perfected the present formula, which was taken over by Merrell-National Laboratories for medical evaluation and large-scale production. The writer of this report has been in personal communication with Mandarino for some years.

The final evaluation of the clinical application and usefulness of polyurethane foam will still take a long time, and whether it will ultimately justify itself or not in the general treatment of fractures, it is too early to tell. But it is now certain that preliminary results are encouraging, and that in every case initial success can confidently be predicted provided the substance is used properly. However, it can very easily be discredited at this stage merely by small errors in operative technique, resulting in avoidable failures.

PHYSICAL AND CHEMICAL PROPERTIES

Polyurethane foam, a plastic polymer of high molecular weight, is formed by the action of a catalyst on a pre-polymer. The catalyst consists of an aliphatic tertiary amine with water in a precise ratio, and the pre-polymer is a polyol, bonded to an aromatic poly-iso-cyanate. When mixed they react to liberate CO_2. This is not a chemical reaction, but a polymerization. The CO_2 diffuses throughout the mixture, producing a sponge-like compound. The catalyst and the polymer are in liquid form and, when mixed in a 1 : 4 ratio, produce a volume approximately 3 times that of the original. The compound has a 7–10% cellular structure, providing a lacunar-like system for the proliferation of bone.

Tests of the strength of polyurethane give the following results:

1. *Bond strength to bone*: from 170–190 lb. per square inch.

2. *Tensile strength*: 2,000 lb. per square inch.
3. *Compressive strength*: 20,000 lb. per square inch with a 10% deflection.
4. *Density*: 25 to 30 lb. per cubic foot.
5. *Shear strength*: 500 lb. per square inch.
6. *Flexural strength*: 1,000 to 1,200 lb. per square inch.

These figures equal or surpass the strength of human bone. Tensile strength is the measure of force necessary to tear the substance apart. The tensile strength of polyurethane depends on thorough mixing. When the prepolymer and catalyst are mixed by hand, the tensile strength is only 800 lb. per square inch. When mechanically mixed, this strength is 2.5–3 times greater. Torsional, shear and flexural analysis are factors of tensile strength which can be measured from it. Flexural strength is measured by bending, when the convex surface is torn apart and the concave surface is compressed. Shear stress is a strain consisting of a compression in one direction with an elongation in the same ratio in a perpendicular direction. Torsional stress follows the same principle. The *tensile* strength is thus used as the most useful measure of the strength of a polyurethane column, and it is the most important factor that really matters in use.

Polyurethane foam is used as a substance for intramedullary fixation of fractures; as it is not a glue, it must be used in such a way that its strength is based on its tensile strength and not on its bonding, flexural or shear strengths. The bonding factor is a great advantage, however, in preventing intermittent intramedullary movement of polyurethane against bone, which might result in compression necrosis. The cross sectional area of a rod increases as the square of its radius. Thus a small increase in diameter of a polyurethane cylinder results in a large increase in added strength. Assuming 2,000 lb. per square inch in any chosen substance, then an increase from 1/3 inch to 1 inch diameter provides an increase in tensile strength from 100 to 1,600 lb. per square inch approximately.

It has been determined that, where the supporting column of polyurethane is less than 5/8 inch in diameter at its narrowest point, some form of additional reinforcement is necessary in using a polyurethane column on a weight-bearing bone.

EFFECTS OF MIXING TIME AND TEMPERATURE ON TENSILE STRENGTH OF POLYURETHANE

On mixing for 7 seconds at 100°F. the high tensile strength plateau is reached. Each 10°F. increase in temperature entails one second *less* of 'beating' time, whilst every 10°F. decrease in temperature requires 1 second *more* 'beating' time, in order to reach the same tensile strength plateau. Adequate mixing is therefore the first essential principle in the successful surgical application of polyurethane.

The control of the heat of reaction of polymerization is also essential. High initial mixing temperatures result in the generation of higher temperatures. When mixed at 120°F. the final temperature may reach 220°F. The polyurethane temperature then exceeds the physiological powers of the tissues to resist heat, and necrosis results. When mixed at room temperature (about 80°F.) the rise is to 168°–170°F. The viscosity varies with the temperature. Mixing below 80°F. initially, increases the viscosity to a point where pouring is extremely difficult. Above 100°F. the viscosity is decreased, but the final temperature causes tissue necrosis.

To summarize:

1. Mechanical 'beating' markedly increases the strength of polyurethane, because it is a more intimate mixing.
2. Heat reaction of polymerization is greater than the body can tolerate if the *initial* heat of the product is greater than 100°F.
3. Use of an apparatus for extrusion of the substance would make it more readily applicable, and would increase its scope. At present it is merely poured.
4. Polyurethane is *not* a glue. Its strength must *not* depend on its bonding, flexural or shear strength. It forms an intramedullary supporting column whose effectiveness rests on its tensile strength.
5. A column adequate in diameter, properly achieved, is mandatory to strength.
6. Metal reinforcement adds widely to its scope of use, and to its inherent strength. (Experiments are contemplated whereby fibre glass will be tried as an extramedullary reinforcing agent).

If polyurethane foam is to be used clinically, its successful use will depend on an intelligent appreciation of, and rigid adherence to, these principles. Any minor deviation could well result in failure, and in the consequent premature discrediting of a substance which holds very great promise.

TOXICITY AND PRE-CLINICAL ANIMAL EXPERIMENTS

Before the clinical application of polyurethane was considered, numerous animal and other experiments were conducted in order to determine its toxicity.

In these toxicological experiments the polyurethane foam was implanted into animals. No overt toxic effects were demonstrated. There was no effect on growth of rats, rabbits, dogs and guinea pigs. There was no alteration in the peripheral blood picture in animals, and

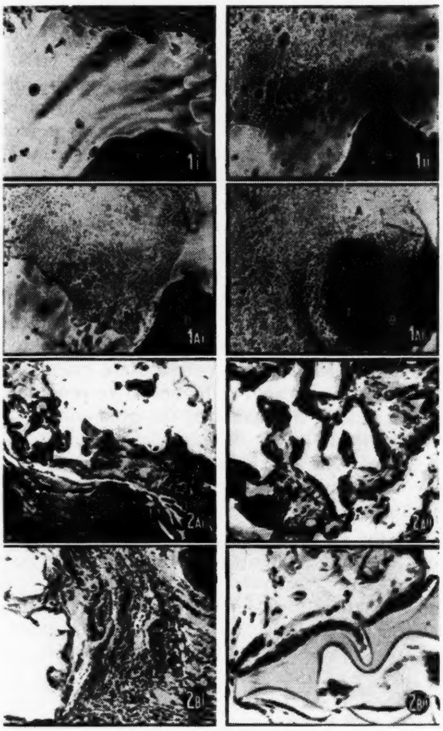


Fig. 1. Tissue culture bioassay of polyurethane sponge. (Hela strain human cells).
i. 24 hours after implantation
ii. 72 hours after implantation.

Fig. 1*a*. i. Seven days after implantation.
ii. Ten days after implantation.
A=Hela cells.
B=Polyurethane sponge fragment.

Fig. 2. Polyurethane sponge implantation subcutaneously in the Wistar rat.
A: Six months after implantation.
i. Low power (X 63).
ii. High power (X 180).

Fig. 2. B. One year after implantation.
i. Low power (X 33).
ii. High power (X 408).

no bone marrow morphological change was demonstrated. Polyurethane had no effect on food consumption and body weight in dogs when implanted next to bone-forming tissue, intraperitoneally or subcutaneously. No toxic diffusible substances were demonstrated in human tissue culture bioassay using Hela strain human cells (Fig. 1). There was a minimal foreign body reaction when implanted subcutaneously in rats (Fig. 2). When placed in apposition to fractured bone ends, it actually stimulated bone growth.

In all the American cases there has been no evidence whatever of toxic reaction. Peripheral blood pictures were studied regularly, liver function tests were performed, and periodic sternal marrow smears were examined. Observation on human cases treated with polyurethane, and followed up since, indicated no toxic reactions; but, of course, such observations have been limited in duration and in numbers.

THE FATE OF POLYURETHANE IN THE BODY

An osteoblastic reaction has been demonstrated into the implant. The osteoblasts proliferate, and invade the lacunar-like system of the polyurethane sponge. The substance is slowly absorbed, so that 1/4 to 1/6 of the original volume is all that remains 12 months after implantation. After 2 years, the polyurethane has been completely replaced by bone (Fig. 3). The metabolic phase is an important aspect of the investigation and it is imperative that the metabolic route be known. The method of 'labelling' with isotopes is being studied, and the preliminary investigations indicate that polyurethane is excreted via the kidneys and liver, but to what extent still remains to be determined.

No evidence as yet of toxic effects on liver or kidneys has been demonstrated, but there must be caution about deciding this point. Cases obviously need to be followed up for a considerable time before final conclusions can be justified.

The fact that the polyurethane is completely replaced by bone within 2 years, in cases followed up, suggests that there is no reason at present to fear any toxic effects from this implant, and it constitutes presumptive evidence that excretion or metabolism are complete. However, this has not yet been proved by other means.

CONDITIONS IN WHICH POLYURETHANE HAS BEEN USED

Polyurethane foam has been used in America for the following conditions:

1. Non-union of long bones.
2. Pathological fractures.
3. Recent compound fractures.
4. Simple acute fractures.

5. Fractures with defects.
6. Fixation of prosthesis.
7. Spinal fusion.
8. Arthrodesis of joints.
9. Covering skull defects.
10. Bridging long bone defects.

It has been claimed successful in all these conditions in the United States of America. Its use in South Africa has been limited to 2 cases with delayed union (one of these with osteomyelitis) and to 6 additional cases of recent fractures. Of the total of 8 cases to date, 7 have been fractures of the tibia, and one a fracture of humerus with delayed union.

Fig. 3. Two-year post-operative X-ray showing process of replacement of polyurethane by bone.

At present, there are no specific criteria for the selection of cases, but the present opinion in America would tend to favour limitation to pathological fractures and to cases of established non-union. This opinion is dictated less by experience than by the innately conservative outlook of the elders of the profession, and by the automatic adherence of their disciples to their views.

It is none the less almost axiomatic that the success of any treatment is directly proportional to its simplicity, and it follows that the use of 'Ostamer' in recent fractures should be confined to surgeons experienced in its application. In the absence of contraindications, it can and should be used in selected cases in order to be correctly assessed and developed, but the haphazard use of polyurethane in unselected fractures, and its 'trial' by the uninitiated would undoubtedly be ill-advised, so long as the procedure involves the technical difficulties with which at present it is associated. The one absolute contra-indication is in cases where the blood supply of the overlying skin is suspect.

OPERATIVE PROCEDURES

The approach and operative procedure will vary according to the site and nature of the fracture. The mixing of the polyurethane and the principles governing its use are essentially the same in all cases. The operative procedure in the case of a fracture of the tibia and fibula is described.

Special Kit. Each kit (Fig. 6) consists of a jar of pre-polymer, a jar of catalyst, a special jar opener, and a wire beater for mixing.

In the case of a tibia, because the diameter of the column of polyurethane is less than 5/8 inch at its narrowest point, some form of additional reinforcement is necessary. Rods and discs have been utilized for reinforcement. The apparatus (Fig. 4) consists of 4 rods and 4 discs, each disc being perforated to hold the rods. The position of the rods and discs can be altered to change the length of the apparatus (Fig. 5). They have been specifically designed for use with polyurethane. However, they are not essential, and can be replaced by other forms of metal intramedullary reinforcement.

After having used Mandarino rods with initial success in several cases, the writer now intends to substitute (Vitallium) Rush nails in future cases, and is abandoning the use of the rods for the sole reason that, should they ever have to be removed, the surgical procedure involved would be unduly major. A single 1/4-inch Rush nail, on the other hand, should afford adequate reinforcement with the added advantage of ease of removal, if such removal should ever become advisable.

It is stressed that intramedullary implants, when used with polyurethane, are meant to remain permanently in place. In view of the recently published work of Scales *et al.* it appears that all ferrous-alloy (even high alloy

chrome-nickel steel) implants are liable to some degree of corrosion in the body, and it follows that the use of ferrous alloys as implants should, if possible, be abandoned, except perhaps in cases where such implants can be readily removed.

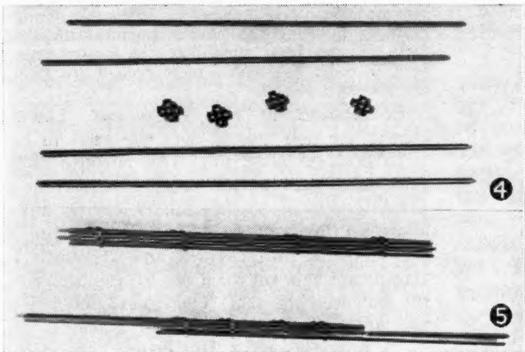


Fig. 4. Mandarino rods and discs, showing components.
Fig. 5. Assembled rods and discs demonstrating method of varying length.
Fig. 6. Special kit, consisting of wire beater, bottle opener, pre-polymer and catalyst.

The cobalt-chromium-molybdenum alloys (Vitallium, Vinertia) were found to be completely non-corrosive on the methods applied in the study referred to, and therefore the following recommendations are made in regard to polyurethane treatment of fractures:

(*a*) Non-ferrous alloys should supersede ferrous alloys as surgical implants.

(*b*) Intramedullary reinforcing implants should be readily removable.

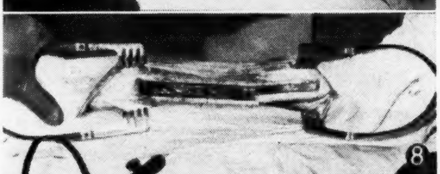


Fig. 7. Exposure of tibia.
Fig. 8. Exposure of medullary canal before curetting and removal of bone marrow.
Fig. 9. Cleaned and dried operative field; bone marrow removed.

Incision. An elliptical incision is made, commencing about 3/4 inch lateral to the tibial tuberosity, continuing down to the medial border of the tibia and ending about 1 inch proximal and medial to the external malleolus. The total length of the incision is thus about 13 inches. The skin is then reflected slightly.

Exposure of Bone. An incision is then made through the deep fascia and periosteum over the centre of the anterior surface of the tibia. The periosteum is carefully reflected from the tibia over the entire length of the incision (Fig. 7).

Sliding Graft. Using a twin-bladed saw, a cortical inlay graft is cut, the graft to be as wide as the width of the tibia will allow. An endeavour is made to obtain a graft at least 6 inches long or, at any rate, as long a graft as is possible (Fig. 8).

Preparation of Site. The medullary cavity is thoroughly curetted. Use of diathermy cautery at this stage may be essential in order to attain absolute haemostasis.

It is essential to have the fracture site dry at the time the polyurethane is poured, in order that blood in the field should not prevent proper adhesion between polymer and bone (Fig. 9). The medullary cavity is finally treated with ether to remove residual bone-marrow fat.

If, notwithstanding all precautions, a medullary ooze persists, this can be obviated by inserting absorbable surgical sponges into the medullary canal above and below the site of the cortical inlay.

The metal reinforcing implant is then placed in position.

Mixing. The kit components have previously been sterilized by autoclaving at 250°F. for 10–15 minutes. Every component must be absolutely dry before being handled by the surgeon; even a single drop of water during polymerization will materially reduce the strength of polyurethane foam.

The pre-polymer and catalyst should be at approximately body temperature (98.4°F.) for the best compromise between ease of handling and speed of setting. This is achieved by immersing the jars in a water bath at a temperature of 100°F. for half an hour before mixing (Fig. 10).

Fig. 10. Jars immersed in water bath at 100° F. for half an hour before mixing.

(*a*) Make sure both jars are thoroughly dry.

(*b*) Jars are opened by loosening lids in several places with the opener.

(*c*) Place the wire beater in the chuck of electric saw.

(*d*) 14 c.c. of the catalyst are then carefully measured off into a completely dry 20 c.c. syringe by pouring into the barrel.

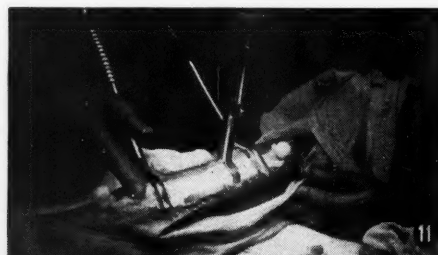
(*e*) This catalyst is then expelled through the nozzle on to the pre-polymer still in the jar as supplied. There is no need for haste at this point, as no reaction will take place until the 2 substances are mixed. The site of operation should be checked for haemorrhage and Lowman clamps placed in position.

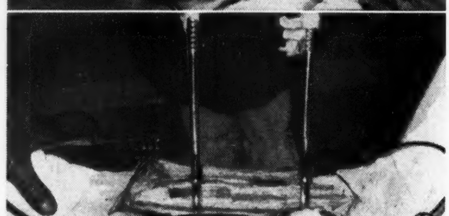
Holding the pre-polymer bottle in the left hand, the wire mixer is rotated at full speed and then immersed in the mixture. Mix at full speed, moving the beater around, and up and down slightly, to assure a homogeneous mix. Mix for 7 seconds, using a stop watch. From this point on, speed is essential.

(*f*) Pour the mix into the prepared site immediately. Rapid working is essential, as a maximum of about 20 seconds only is available for this stage.

(*g*) *Replace the intact bone graft to bridge the fracture site,* at the same time closing any defect of the medullary cavity above or below the bridging graft by inserting the smaller fragment of cortical bone. Some hand moulding can be resorted to here, in order to obtain a more even distribution of the polyurethane.

Completion of the Technique. Lowman clamps are now placed over the graft to keep it in position (Fig. 11). The purpose of this graft is to prevent the polyurethane from expanding out of the medullary cavity, and to allow an inward expansion, thus forcing the polyurethane into cavities and crevices. The clamps are kept on for a full 20 minutes whilst the polyurethane sets. The excess polymer can be cut off and trimmed with a scalpel after 5–10 minutes, while the clamps are still in place (Fig. 12). Fig. 13 illustrates the site after removal of the clamps and trimming of excess polyurethane foam. The force of the





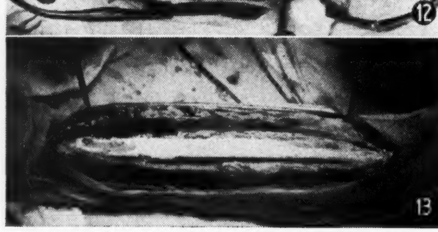


Fig. 11. Lowman clamps in position over graft after pouring mixture.

Fig. 12. Excess polymer trimmed, before removal of clamps.

Fig. 13. Site after removal of clamps with graft *in situ*, preparatory to closure of wound.

expanding polyurethane is such that it will extrude any graft which is not actually clamped down until the setting is complete.

Suture and P.O.P. The tourniquet is now released and hot packs are used to stop oozing, and 'spurters' are secured and tied. Diathermy cautery is useful at this stage. Every endeavour must be made to secure absolute haemostasis in order to prevent subsequent haematoma formation. The periosteum and the skin are then closed separately, a light P.O.P. cast is applied, *without any padding,* but using a thick anterior and posterior slab extending over the ankle in each case. The P.O.P. is removed as soon as swelling has subsided, usually on the 3rd, 4th or 5th post-operative day. It should be added that whenever any form of padding was used, there was some degree of haematoma formation. This did not occur with unpadded casts, but such casts not only require careful application, but also demand constant supervision of the limb.

CUMULATIVE SUMMARY OF CLINICAL APPLICATION OF POLYURETHANE FOAM

Up to November 1959, 458 cases had been treated with polyurethane in America. These operations had been performed by 141 different orthopaedic surgeons over a period of 4 years. Of the 458 cases notified there were 50 failures, or an overall 10.9% failure rate. Failure was defined where obvious movement could be felt at the fracture site necessitating the subsequent application of a plaster cast, or where obvious displacement of fracture alignment occurred post-operatively. A successful case was defined as 'a case in which a patient could walk with full weight-bearing'. This latter definition is obviously incomplete, and it would seem that the following criteria of success should be applied:

1. Resumption of normal activities very much sooner than could be attained by any other method of treatment;
2. Functional recovery without disability, or with residual disability not exceeding 5%;
3. Freedom from pain.

It should be noted that a patient's complaint of pain is very often discounted by Assessment Boards unless there is independent evidence to support the complaint; nevertheless pain in itself, not necessarily accompanied by limitation of movement, does occur, and does constitute a very real disability.

In the first 40 consecutive failures the cause was due to one, or several combinations, of the following reasons:

1. *Surgical technique* (5 *cases*).
Too short an inlay graft.
Discarding of graft.
2. *Inadequate mixing* (11 *cases*).
The earlier methods of mixing were crude and inadequate and resulted in a few failures. The strength of polyurethane can be reduced as much as 50% by inadequate mixing.
3. *Inadequate haemostasis* (7 *cases*).
Polyurethane will not adhere to a bloody or to a fatty surface, and dryness is essential for success.
4. *Severe osteomyelitis* (4 *cases*).
5. *Lack of reinforcement* (12 *cases*).
6. *No determined cause* (1 *case*).

As the originator of this new type of fracture treatment, and having learned the exacting surgical technique required, Dr. Mandarino has had the best results. He has done 60 cases with only 5 failures, all of which occurred in fractures of the tibia. The failures in 3 cases were attributable to extensive skin and soft tissue damage. In the other 2, failure was the result of errors in surgical judgment.

The following is an account of one of Dr. Mandarino's cases, actually seen and examined by the writer 6 weeks after operation:

A young man (26 years old) had a severe compound fracture of the lower third of the left tibia and fibula. He had an established non-union with osteomyelitis, and had had draining sinuses for 4 years. He was despondent and facing financial ruin. Two months after operation he had good union, was doing weight-lifting exercises, lifting 126 lb. from the knee-bend position. He goes for a 20 mile walk every week-end, and has *full* range of movement at knee and ankle. He has a well-healed, healthy scar. He was back at his normal work, loading flat cars, 3 weeks after operation.

Eight cases of fractures were treated at The Ernest Oppenheimer Hospital, Welkom, and their description constitutes a preliminary report only; it is not intended as yet either to advocate or to discourage the use of polyurethane. Whether, in fact, polyurethane foam will justify itself or not in the general treatment of fractures, it is too early to tell. What is certain is that preliminary results are encouraging.

CASE NO. 1

A 34-year-old Bantu male sustained a fracture of the left tibia on 18 July 1959. Polyurethane foam was used as a means of intramedullary fixation. No additional means of reinforcement was used and no P.O.P. cast was applied. The day after operation there was considerable oedema of the leg. On the 7th post-operative day it was noticed that there was a foot-drop, but despite this the patient was allowed up. A month later the tibia was exposed and it was found that there was complete necrosis of the muscles in the anterior compartment of the leg.

In the opinion of the writer, and having regard to the experience with polyurethane in America and here, this necrosis was attributable to the original injury.

Fig. 14. Case No. 1. Post-operative X-ray.
Fig. 15. Case No. 1. Patient standing on the 13th post-operative day.

Early in January 1960 the patient still had movement at the fracture site, with discharging sinuses, and he had a foot-drop. On 5 January 1960, the tibia was again exposed, and the polyurethane column was found to have fractured at the site of the original fracture. The infection had not interfered with the polyurethane, which presented the appearance of invasion by blood vessels, and was firmly adherent to the adjacent bone. It was removed with an osteotome with some difficulty, and was replaced with fresh polyurethane, utilizing Mandarino rods and discs for additional reinforcement (Fig. 14). Six days after operation the patient was allowed up and the sinuses were dry. He has continued to improve and is fully weight-bearing without additional support (Fig. 15).

CASE NO. 2

A 25-year-old Basuto sustained an oblique comminuted fracture of the lower third of the left tibia and fibula (Fig. 16). Polyurethane

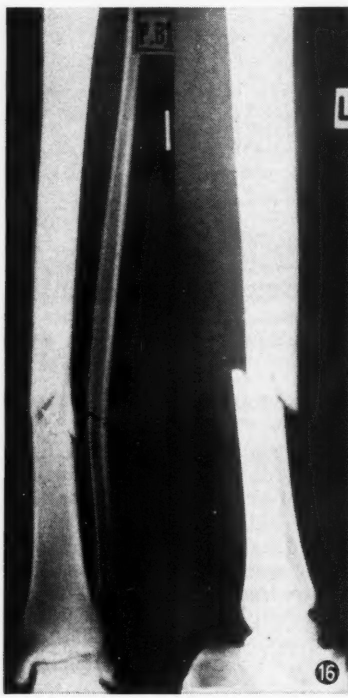


Fig. 16. Case No. 2. Pre-operative X-ray.
Fig. 17. Case No. 2. Post-operative X-ray.
Fig. 18. Case No. 2. Standing on injured leg on 27th post-operative day.

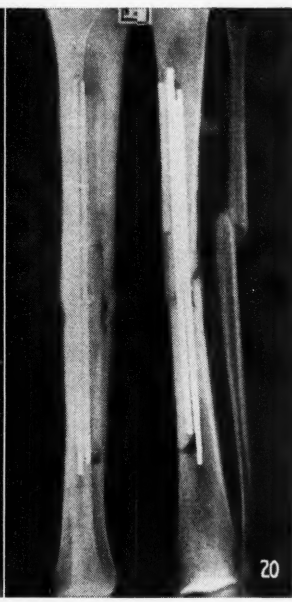
was used for internal fixation without additional reinforcement. On the 5th post-operative day he was standing and walking painlessly without additional support, and this he continued to do for 8 weeks; then he felt a sudden pain at the fracture site whilst exercising in the Physiotherapy Department. After a further 11 weeks of immobilization movement was still present at the fracture site, and the tibia was therefore again exposed. There was no evidence of infection, but the polyurethane column had fractured at the site of the old fracture in the bone. Polyurethane was re-applied using rods and discs for reinforcement (Fig. 17). Nine days later he was allowed up. He has been fully weight-bearing since, and is progressing favourably; he was walking on the 23rd post-operative day without any limp, and had full movement at the ankle and knee joints (Fig. 18).

CASE NO. 3

A 30-year-old Basuto was admitted with a simple fracture of the mid-shaft of the left tibia and fibula (Fig. 19). At operation polyurethane was inserted without additional reinforcement. He was allowed up on the 5th post-operative day. One month later definite movement was detected at the fracture site. Four and a half months later, in spite of immobilization in P.O.P., there was still movement at the fracture site, so he was re-operated upon. The polyurethane was found to be well adherent to the medullary canal with signs of invasion by blood vessels. The polyurethane column had, however, fractured at the old fracture site. Polyurethane was re-appplied, using additional reinforcement in the form of rods and discs (Fig. 20). Eight days later he was allowed up. He is now walking well and is progressing favourably (Fig. 21). This patient had a pre-operative positive Wassermann reaction which is still positive 5 months later, despite intensive treatment.

It was evident that the initial results after the first operation in these 3 cases were very disappointing.

The procedure was therefore studied at first hand by the author in the United States of America. On returning to South Africa, the second operation was performed on the 3 cases cited, utilizing the knowledge gained in the United States. A further 5 cases were then operated on.



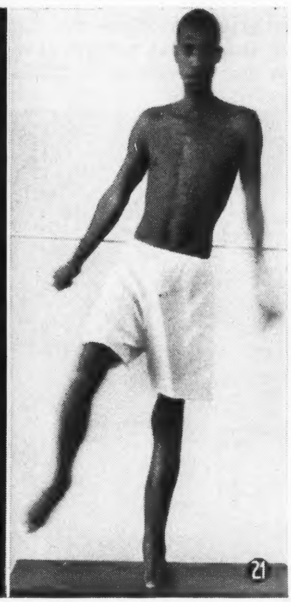


Fig. 19. Case No. 3. X-ray of original injury.

Fig. 20. Case No. 3. Post-operative X-ray.

Fig. 21. Case No. 3. Patient standing on injured leg on 19th post-operative day.

CASE NO. 4

This was a delayed union of the humerus of 6 weeks' duration, with angulation and distrac-

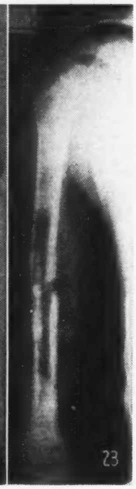


Fig. 22. Case No. 4. Pre-operative X-ray.
Fig. 23. Case No. 4. X-ray taken on 23rd post-operative day demonstrating early callus formation.

tion (Fig. 22). There was marked elbow stiffness and wasting pre-operatively. Polyurethane was inserted without additional reinforcement, a collar of polyurethane being placed around the fracture site before suturing the periosteum, which could not therefore be accurately approximated. The upper limb was immobilized in P.O.P. for 3 days. The post-operative course has been uneventful, and the patient is undergoing intensive physiotherapy in an endeavour to regain the lost elbow movement and to improve the musculature. The fracture is firm, the patient is entirely free from pain, and movement of the elbow is improving. An X-ray taken on the 23rd post-operative day indicates invasion of this polyurethane collar by callus (Fig. 23).

CASE NO. 5

A Basuto mine worker sustained an oblique fracture of the middle of the right tibia and fibula (Fig. 24) and contusion of the right knee. At operation it was found that there was marked muscle damage and haematoma formation. Polyurethane was inserted, using rods and discs for additional strength (Fig. 25). On the 9th post-operative day the patient was allowed up. He now walks well, is fully weight-bearing and is progressing satisfactorily (Fig. 26).

CASE NO. 6

A Native mine labourer sustained a fracture of the lower third of the right tibia and fibula (Fig. 27). At operation the first 'pour' of

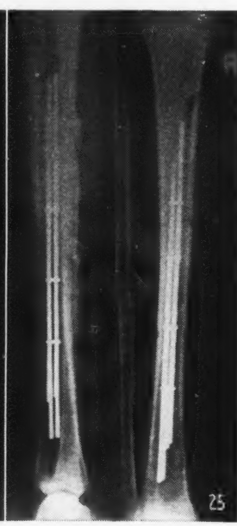
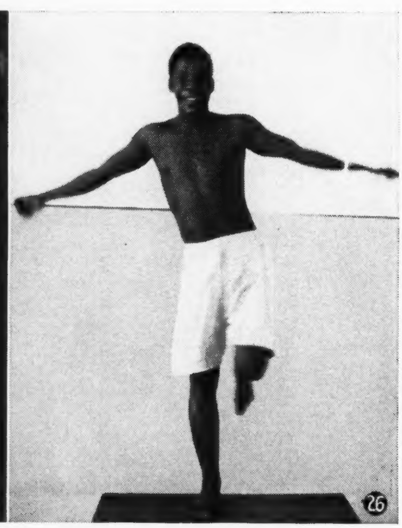




Fig. 24. Case No. 5. Pre-operative X-ray.
Fig. 25. Case No. 5. Post-operative X-ray.
Fig. 26. Case No. 5. Patient standing on injured leg on the 16th post-operative day.

polyurethane proved unsatisfactory owing to inadequate mixing. This was immediately

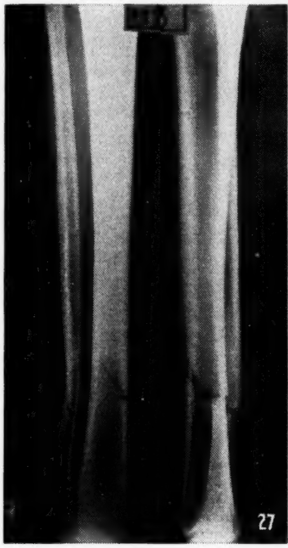
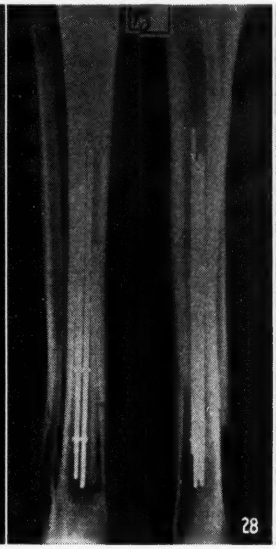
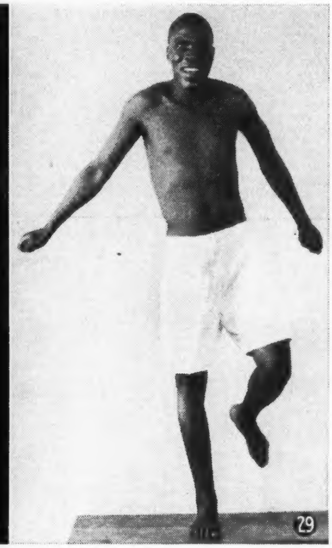




Fig. 27. Case No. 6. Pre-operative X-ray.
Fig. 28. Case No. 6. Post-operative X-ray.
Fig. 29. Case No. 6. Standing on injured leg on 14th post-operative day.

removed and a new mixture applied. Rods and discs were again used as a means of reinforcement (Fig. 28). On the 7th post-operative day he was allowed up. He is walking well and his progress is satisfactory (Fig. 29).

CASE NO. 7

A Bantu male mine labourer had an oblique comminuted fracture of the lower third of the

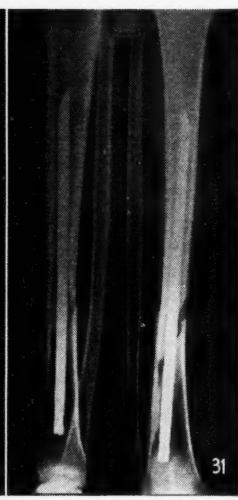
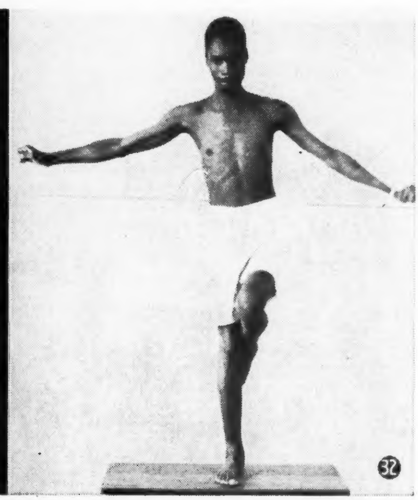



Fig. 30. Case No. 7. Pre-operative X-ray.
Fig. 31. Case No. 7. Post-operative X-ray.
Fig. 32. Case No. 7. Patient standing on injured leg on 12th post-operative day.

right tibia and fibula (Fig. 30). Polyurethane was poured at the operation over a Kuntscher nail inserted in the prepared medullary canal (Fig. 31). The patient was fully weight-bearing



Fig. 33. Case No. 8. Pre-operative X-ray demonstrating that union is not yet in progress.
Fig. 34. Case No. 8. Immediate post-operative X-ray.
Fig. 35. Case No. 8. Weight-bearing on 11th post-operative day.

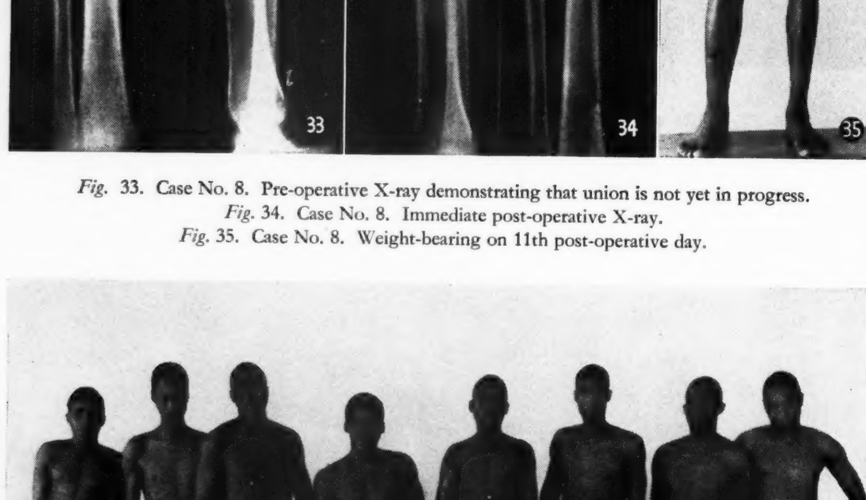


Fig. 36. The 8 cases described in the text, numbered 1 to 8 from the right.

on the 6th post-operative day. He is walking well, there are no complications and his progress is satisfactory (Fig. 32).

CASE NO. 8

A poorly nourished tropical Bantu labourer had an un-united fracture of the upper third of the right tibia. He had sustained his injury 8 weeks before. The X-ray showed some osteitis of the tibia with no callus formation (Fig. 33). At operation it was found that there was osteitis of the entire shaft of the tibia, and the bone was very soft and friable. Polyurethane was inserted, using a Sherman plate as reinforcement (Fig. 34). Five days after the operation he was allowed up. The wound healed well and there has been no pain. His progress is satisfactory (Fig. 35).

Figure 36, a photograph taken on 18 January 1960, shows the 8 cases. (It will be noted that Case No. 8—on the left—is not standing on the injured leg. This was noticed only after the photograph had been taken; but he is now, and was then, fully weight-bearing.)

In the *last* operation in each case, a Plaster of Paris cast was used for the first 3 post-operative days. The use of an unpadded plaster cast for a few days is not intended as an additional means of immobilization, but as a measure to prevent localized haematoma formation and to control oedema. The application of anterior and posterior slabs in these cases is regarded by the author as mandatory.

A remarkable feature in all cases was the absence of pain postoperatively.

Toxicity studies were conducted on all cases. The following tests were done pre-operatively and at regular intervals post-operatively:

urinalysis; blood sugar; thymol turbidity; thymol flocculation; cephalin cholesterol; blood urea; bromsulphthalein excretion, blood electrolytes, full blood count, and bone marrow studies. In no case has there been any evidence of toxicity.

DISCUSSION

The unsuccessful results obtained with the use of polyurethane can, in nearly every case, be explained by faulty technique and judgment. The initial results of the first 3 operations at The Ernest Oppenheimer Hospital illustrate this fact. The object of this paper is therefore to clarify the procedure, to mention the technical problems likely to be encountered, and to stress the need for careful consideration in the selection of cases. The field of usefulness must be mapped out with caution—it is still largely uncharted territory. But if the substance is used at all, it must be used correctly. The margin for error is too slight to permit of haphazard experiments, and the substance will be discredited no less effectively if it fails because of incorrect use, rather than because of its own innate defects.

Its usefulness in pathological fractures and in non-unions is now well established. More work has still to be done before its use in recent fractures can be justified fully, except perhaps in the femur, where absence from normal activities is usually prolonged even where some form of internal fixation is employed. However, the preliminary experience in recent fractures is very encouraging. The comparatively few cases treated in the U.S.A. and locally indicate that the acute fracture can respond even better than cases of non-union and pathological fractures.

At first thought, 7 seconds and 20 seconds seem to involve the kind of timing which is more appropriate to athletics than to a surgical operation. Nevertheless, both times have been carefully worked out as a result of trial and error and in actual fact they afford time to spare in carrying out the procedures laid down.

Those who intend to use 'Ostamer' should experiment with mixing and pouring, using a stop watch, until they are satisfied they have mastered the technique and are familiar with the behaviour of recently-formed polyurethane, by practising, for example, on animal bone under simulated operating theatre conditions. It will then become obvious that the purpose of the graft over the fracture site is to restrain the polyurethane from expanding upwards, instead of along the medullary cavity. The clamped graft over the fracture site merely channels the expansion of the polyurethane, which is automatically moulded by the medullary cavity into a rod.

SUMMARY

1. The development of polyurethane foam as a means of internal fixation in the treatment of fractures is discussed.

2. The physical and chemical properties are evaluated, and stress is laid on the meticulous preparation required when it is used clinically.

TABLE 1: TABULATION OF FIRST EIGHT CASES

Case No.	*Date of Injury*	*Age*	*Injury*	*Past History*	*Infection Present*	*Date of Operation*	**F.W.B. **Days*	*Additional Reinforcement*	*Remarks*
1	11/7/59	34	Simple transverse fracture lower 1/3 L. tib. & fib. Ant. Tibial Syndrome.	Initial Ostamer without reinforcement failed. Repeat Ostamer with reinforcement on 5/1/60, 22/12/59 and 30/12/59.	Yes	5 January 1960	6th	Rods and Discs	Persistent foot drop. Walking well. Progress satisfactory.
2	21/7/59	25	Simple oblique comminuted fracture lower 1/3 tibia & fibula.		No.	22 December 1959	9th	Rods and Discs	Progress satisfactory. Walking well.
3	5/8/59	30	Simple fracture mid shaft left tibia & fibula.		No	30 December 1959	8th	Rods and Discs	Progress satisfactory. Walking well.
4	21/11/59	20	Simple fracture middle 1/3 humerus.	No union after 6 weeks.	No	29 December 1959	—	Nil	Clinically fit to resume normal work after 30 days. Good callus.
5	1/1/60	19	Simple oblique fracture middle R. tibia & fibula. Contusion knee.	—	No	2 January 1960	9th	Rods and Discs	Walks well. Movements full. Slight pain knee.
6	2/1/60	32	Simple fracture lower third tibia & fibula.	—	No	4 January 1960	7th	Rods and Discs	Clinically fit to resume work after 30 days.
7	4/1/60	24	Simple oblique comminuted fracture lower 1/3 R. tibia & fibula.	—	No	6 January 1960	6th	Kuntscher Nail	Clinically fit to resume work after 30 days.
8	12/11/59	20	Simple transverse fracture upper 1/3 R. tibia.	No union after 8 weeks.	Yes	7 January 1960	5th	Sherman Plate	Progress satisfactory. Walking well. Movements full.

* Full Weight-Bearing. ** Indicates post-operative day.

3. The toxicity studies are mentioned.

4. The indication for its use, and the operative procedure, are described.

5. A cumulative summary of the clinical application of polyurethane foam in America is presented.

6. Eight cases are mentioned as a preliminary report on the use of polyurethane at The Ernest Oppenheimer Hospital.

7. In a successful case the patient is fully weight-bearing, without any additional support, within 5 days.

8. Caution in the selection of cases is advised until polyurethane can be fully evaluated.

It is stressed that knowledge can be attained only by experience, however, and in a field so promising it is felt that the substance should be used without unnecessary mental reservation, provided (*a*) the surgeon is aware of the technical difficulties and is thoroughly familiar with the technique demanded, and (*b*) that there is a sufficiently long follow-up of every case to enable a correct evaluation to be made.

Those who 'do not like it' and cannot adduce any valid reason for not 'liking' it should take care to leave it alone. Those others who, like the writer, feel strongly that pain, disability and enforced idleness (with its associated psychic trauma) present a continuing challenge to the medical profession, would do well to investigate this matter further.

It is stressed again that this is not a method for the inexperienced, the impatient or the inept, nor for those who 'try' it against their better judgment, or against their innate surgical beliefs. No one, indeed, should 'try out' this technique on any patient unless he has previously practised it and mastered it, and many may find irksome the insistence on rigid adherence to detail at this stage. But only if polyurethane is replaced by some substance even more suitable for the treatment of fractures, is it likely that the present exacting technique will be modified.

At the present stage of our knowledge, treatment of fractures with polyurethane is by no means to be recommended as a standard or routine method. It is merely a method which has recently become available for the treatment of fractures which either do not, or are unlikely to, respond to more conventional methods. Its use in recent fractures must be determined by individual circumstances, in view of the fact that no absolute indications have yet been formulated for such cases.

With the passage of time, if it be accompanied by simplification of technique, the use of non-toxic, slowly absorbable intramedullary implants, which do not interfere with ordinary callus formation, may yet provide the ideal method of treatment for all fractures.

I would like to thank the Transvaal and Orange Free State Chamber of Mines for its financial grant-in-aid, and the Anglo American Corporation of S.A. Ltd., for the financial and other assistance which made this study possible. I am indebted to Dr. J. H. G. van Blommestein (Medical Consultant of the Anglo American Corporation) for his support of this project, and to the Medical Superintendent of The Ernest Oppenheimer Hospital for his stimulating advice, continued encouragement, and his assistance in compiling this paper. I record also my appreciation of the help given to me by my medical colleagues and the technological staff of The Ernest Oppenheimer Hospital.

Finally, I express my thanks to Dr. W. Gerald Morson, Medical Director of Merrell-National (Overseas) Laboratories, for making supplies of Ostamer freely available and, last but not least, to Dr. Michael P. Mandarino of Philadelphia, the originator of this form of treatment, for devoting so much of his time to explaining the technique and demonstrating his cases.

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Appendix I

SUMMARY OF OPERATIVE PROCEDURE

Fig. 1. 'Ostamer' Kit. Jar of pre-polymer, jar of catalyst, wire beater, bottle opener and instruction leaflet.

Fig. 2. Compound fracture of tibia and fibula. Pre-operative condition.

Fig. 3. Cutting the graft.

Fig. 4. Graft cut, before cleaning of graft and medullary cavity.

Fig. 5. Graft and medullary cavity cleaned of marrow and fat. Absolute haemostasis secured. Mandarino rods in position. Site ready for 'pour.'

Fig. 6. Pouring polyurethane into the prepared site. Lowman clamps in place.

Fig. 7. Lowman clamps tightened over graft. Trimming of excess polyurethane.

Fig. 8. Tourniquet released, bleeding points secured. Lowman clamps removed, preparatory to closure of wound.

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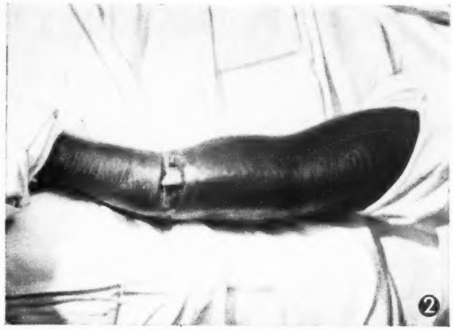
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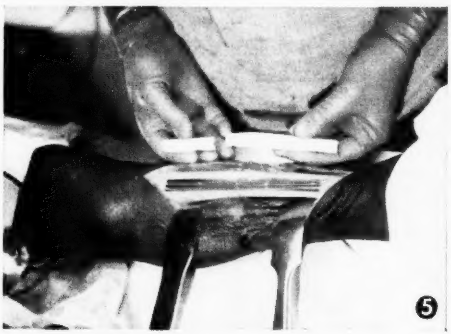
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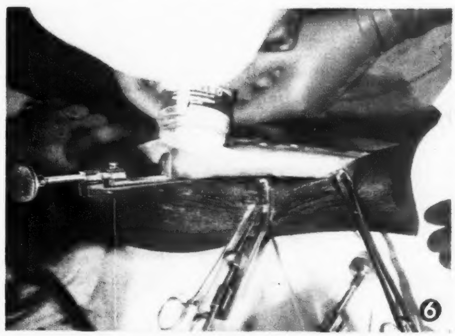
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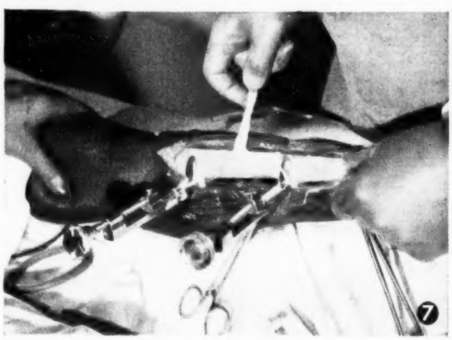
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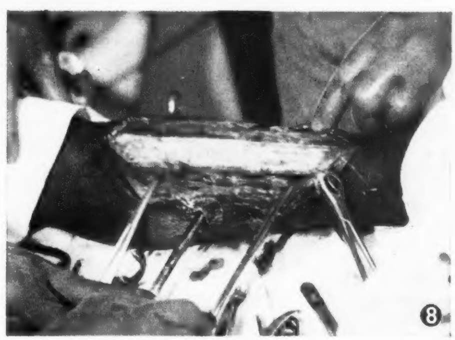
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A GLYCOSURIA SURVEY IN AN INDIAN COMMUNITY IN DURBAN

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King George V Hospital, Durban

Diabetes mellitus has a high prevalence in certain racial groups, one of which is the Indians of Natal. A long-term tuberculosis survey of a defined Indian community is in progress. It is of interest that 2 recent cases of pulmonary tuberculosis were diagnosed in women, with no known tuberculosis family contact, after reference from a diabetic clinic 15 and 16 months after routine chest X-rays had been clear. A glycosuria survey of this community was undertaken to estimate the extent of the diabetic problem.

About 5,300 Indians live in 650 homes in the Springfield sub-economic housing scheme. The population is young, only 40% being over 20 years and 25% over 30 years. Each of the 650 homes was given a number and a 10% sample was selected using a table of random numbers. Health Assistants took an unofficial census of residents over 20 years old, and collected morning specimens of urine for testing. Of the 223 persons enumerated, specimens of urine were not obtained from only 3—a male of 61 years, a female of 50 years and a mentally deficient female of 39 years.

Urine was tested with 'Tes-Tape' (Lilly). Positive reactions were confirmed with Benedict's solution. There were 6 known diabetics (2.7%) and 5 of these had glycosuria. In all, 14 persons (6.4%), including 5 known diabetics, had glycosuria (Table 1).

When glycosuria was present, wherever possible a second urine examination and a fasting blood sugar estimation were done in an attempt to establish a diagnosis of diabetes. Results of these examinations are summarized in Table 2. Investigation of these cases is not complete, and was difficult as several people were reluctant to take time off work.

The probable prevalence of diabetes in the sample population in adults over 20 years was 5.5% (12 of 220 cases) and in adults over 30 years it was 8.8% (12 of 136 cases). Only half these cases were known before this survey was undertaken. On the basis of these figures one would expect there to be between 8,000 and 14,000 diabetes sufferers in the half-million Indian population of Natal.

Diabetes has been described as a disease of good living, but this Indian community which lives in a sub-economic housing scheme, does

Table 1: Prevalence of Glycosuria

Age in Years / *Sex*	20–24			25–29			30–34			35–39			40–44		
	Male	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*
Total Tested ..	28	24	52	15	17	32	15	12	27	8	10	18	12	10	22
Known diabetics											1	1		1	1
Glycosuria 0·1%				2		2								1	1
0·25%															
0·5%											1	1			
2% or more								1	1						
Total Glycosuria				2		2		1	1		1	1		1	1

Age in Years / *Sex*	45–49			50–54			55–59			60–64			65 *and over*			*Total*		
	Male	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*
Total Tested ..	12	15	27	7	9	16	5	6	11	1	3	4	10	1	11	113	107	220
Known diabetics							2	1	3							2	3	5
Glycosuria 0·1%		1	1				1	1	2							3	3	6
0·25%													1		1	1		1
0·5%																	1	1
2% or more				1		1	1		1	1		1	2		2	5	1	6
Total Glycosuria		1	1	1		1	2	1	3	1		1	3		3	9	5	14

TABLE 2: Results of Investigation of Cases of Glycosuria

Case Number	*Sex*	*Age*	*First Urine Test*	*Second Urine Test*	*Fasting Blood Sugar (mg. per 100 ml.)*	*Previous History*	*Remarks*	*Conclusions*
1	M	26	0·1%	Nil	112	—	—	Not diabetes
2	M	29	0·1%	Nil	—	—	—	Not diabetes
3	M	51	2% or more	—	256	—	—	Diabetes
4	M	57	0·1%	—	—	— —	Would not attend for investigation	Not proven
5	M	59	2% or more	—	—	Known diabetic, on treatment	Under care of general practitioner, hence not investigated	Diabetes
6	M	59	Nil	—	—	Known diabetic, on treatment	Husband of (11)	Diabetes–controlled
7	M	61	2% or more	2% or more	208	—	—	Diabetes
8	M	70	0·25%	0·1%	130	—	—	Diabetes–mild
9	M	73	2% or more	2% or more	240	Known diabetic, not on treatment	—	Diabetes
10	F	30	2% or more	Nil	152	—	—	Diabetes–labile
11	F	36	0·5%	—	—	Known diabetic, on treatment	After first test was admitted to general hospital for treatment of diabetes. Wife of (6)	Diabetes
12	F	40	0·1%	—	75	Known diabetic, on treatment		Diabetes–controlled
13	F	45	0·1%	0·1%	—	—	—	Diabetes–mild
14	F	55	0·1%	—	118	Known diabetic, on treatment	—	Diabetes–controlled
15	F	72	2% or more	—	—		Refused investigation as daughter died of diabetes	Diabetes

not live well. It is of interest that even in this small survey, 2 families had more than one diabetic member—a husband and wife (Cases 6 and 11), and a mother (Case 15) and a deceased daughter. Dietary characteristics, of the race as a whole and certain families in particular, may well be a predisposing or causative factor. This survey has attempted not to solve such questions, but rather to outline a problem for elucidation.

I wish to thank Dr. R. Maller, Medical Officer, Springfield Health Centre, for assistance in investigating the cases of glycosuria, and Health Assistants R. B. Singh and B. Salig for the energetic field work which made this survey possible.

NOTES AND NEWS : BERIGTE

Mr. Louis du Plessis, Thoracic Surgeon of Johannesburg, has left for London to attend a course in cardiac surgery organized by the British Council.

Mr. du Plessis expects to be back in Johannesburg by the end of April 1960.

* * *

Dr. Louis du Plessis, Thorax Chirurg van Johannesburg, het vertrek na London om 'n kursus in hart chirurgie by te woon.

Hy verwag om teen die einde van April terug te wees.

COLLEGE OF GENERAL PRACTITIONERS WITWATERSRAND FACULTY

LECTURE BY PROF. D. J. DU PLESSIS (PROFESSOR OF SURGERY OF THE UNIVERSITY OF THE WITWATERSRAND)

Prof. D. J. du Plessis will lecture on *Cholecystitis* on 26 April 1960 at 8 p.m. at the lecture Theatre at the South African Blood Transfusion Service, Corner of Klein and Esselen Streets, Hillbrow, Johannesburg.

Members and guests are welcome.

Note: Meetings of the Faculty are always held on the last Tuesday of every month, except for the month of December.

Dr. L. J. A. Loewenthal has been elected a Member of the Board of Directors of the recently founded International Society of Tropical Dermatology. He has also been made a Corresponding Member of the Austrian Dermatological Society.

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PROFESSOR FANCONI'S VISIT TO SOUTH AFRICA

Professor Guido Fanconi (of Zurich) will be paying a visit to South Africa, by invitation of the S.A. Paediatric Association, at the end of March and during April.

Professor Fanconi will attend the 4th Paediatric Congress which will be held in Cape Town from 4 to 6 April. In addition, arrangements have been made for him to visit several of the larger medical centres where he will deliver lectures on various paediatric subjects.

Professor Fanconi is head of the Department of Paediatrics at the University of Zurich and Director of the Children's Hospital in that city. He is a member of numerous learned Societies in Europe and the Americas and has been the recipient of several honorary degrees and decorations.

Professor Fanconi is the author of many original scientific publications and monographs, several syndromes being known by his name. He is co-author (with Professor Wallgren of Sweden) of the well known *Textbook of Paediatrics* and is the Editor of *Helvetica Paediatrica Acta.*

At present Professor Fanconi is Secretary-General of the International Paediatric Association and he has in the past served as its President.

Professor Fanconi's visit to South Africa has been made possible by a travel grant provided by Nestlé (South Africa) (Proprietary) Limited.

PROFESSOR FANCONI'S VISIT

UNDER THE AUSPICES OF THE S.A. PAEDIATRIC ASSOCIATION

26-29 March: Johannesburg.

In conjunction with the Southern Transvaal Branch of M.A.S.A. and Medical Graduates Association.

Lecture: Tuesday 29th, 8.15 p.m. Harveian Theatre, Medical School. *Prenatal Pathology: Some New Aspects of Hereditary Diseases, Chromosomal Aberrations and Post-Conceptional Pathology.*

30-31 March: Pretoria.

In conjunction with the Northern Transvaal Branch of M.A.S.A.

Lecture: Wednesday 30th, 8.15 p.m. *Electrolyte and Water Therapy.*

1-2 April: Bloemfontein.

In conjunction with the O.F.S. Branch of M.A.S.A.

Lecture: Friday, April 1st, 8.15 p.m. *Prenatal Pathology.*

3-6 April: Cape Town.

In conjunction with the Cape Western Branch of M.A.S.A.

Lecture: Monday, April 4th, 8.15 p.m. *Prenatal Pathology.*

Fourth Paediatric Congress.

Paper on *Some New Aspects of the Physiology and Pathology of Calcium and Phosphorus Metabolism.*

8-9 April: Port Elizabeth.

In conjunction with the Cape Midlands Branch of M.A.S.A.

Lecture: Friday, April 8th, 8.15 p.m. *Electrolyte and Water Therapy.*

9-11 April: Durban.

In conjunction with the Natal Coastal Branch of M.A.S.A.

Lecture: Monday, April 11th, 8.15 p.m. *Problems of Nephrosis.*

BOOK REVIEW

SURVEYS OF IMMUNOLOGY AND HAEMATOLOGY

Immunological and Haematological Surveys: Report of a Study Group. World Health Organization: Technical Report Series, 1959, No. 181. 35 pages. 1s. 9d. Pretoria: Van Schaik's Bookstore (Pty.) Ltd., P.O. Box 724.

Serological surveys are of value in many different areas of research and have been used for decades to provide information on the distribution of certain infectious agents and the immunity status of populations. More recently the value of these surveys has been increased by making provision for the examination of the specimens collected for antibodies to several different agents over and above the primary objective of the survey. A logical extension of this is proposed in the report of the WHO Study Group on Immunological and Haematological Surveys and is based on the fact that the blood samples collected in these surveys contain many substances of medical interest in addition to antibodies. These include biochemical substances of importance in nutrition and various chronic diseases, e.g. cholesterol, proteins and vitamins; and haematological substances of importance in anaemias and human genetics, e.g. red blood cells, haemoglobins, both normal and abnormal, and blood groups. With suitable techniques, a single survey can throw light on problems associated with all these diverse substances. Furthermore, by storing part of the specimens collected in stable form, the survey may also throw light on health problems which will arise in the future, thus providing not only a cross-section of the existing situation in the population but also a longitudinal picture in time of changing disease patterns. Extension of these proposals to domestic and wild animals which are the hosts of many human diseases will further increase our knowledge of the ecology of such conditions.

These and other questions are discussed in the *Report of the Study Group.* Detailed indications are given about methods of population sampling and the techniques to be employed in obtaining, dispatching and treating blood samples for use in multi-purpose surveys. The *Report* stresses the importance of establishing international collections of sera under the administrative control of WHO, and recommends the initiation of a series of pilot studies to determine whether the technical procedures it outlines are feasible in practice.